M E M O R A N D U M

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TO: IEA Annex 23 OC^3 Participants

CC:

FROM: Tim Camp, Garrad Hassan

SUBJECT: **Wave Kinematics & Surface Elevation Data**

This note describes the format of the wave kinematics and surface elevation data supplied to the OC^3 participants for the purpose of the code comparison exercise.

The table of load cases [1] specifies three different wave conditions:

- A regular Airy wave of height 6m and period 10s. This condition is subsequently abbreviated as "RegAiry".
- A regular stream function wave of height 6m and period 10s. This condition is subsequently abbreviated as "RegSF".
- An irregular linear (Airy) wavetrain with significant wave height 6m and peak spectral period 10s. This condition is subsequently abbreviated as "IrregAiry".

In all three cases, the mean water depth is taken to be 20m.

A reference frame is chosen such that x and y axes lie in a horizontal plane. The x-axis points in the direction of wave propagation, while the y-axis is perpendicular to the direction of wave propagation. The z-axis points vertically upwards and has its origin at the mean water level (MWL). Thus the sea bed has a z-coordinate of -20m.

The accompanying datasets specify the time histories of surface elevation and water particle kinematics for each of the above three cases. The data is supplied in two datasets per wave case: files ending "_surface.txt" contain surface elevation time history data, whilst files ending "_kinematics.txt" contain water particle kinematics time history data. Thus the file "RegAiry_surface.txt" contains surface elevation data for the regular Airy wave case.

For the regular Airy case, an additional spreadsheet file is included: "RegAiry_format.xls". This file explains the format of the text files, this format being common to each of the three wave cases.

The water particle kinematics is specified in terms of:

- Water particle x-velocity
- Water particle y-velocity (always zero in these cases)
- Water particle z-velocity
- Water particle x-acceleration
- Water particle y-acceleration (always zero in these cases)
- Water particle z-acceleration
- Dynamic pressure

The above parameters are specified at 42 points along a vertical line (assumed to be the centre-line of a monopile turbine support structure). These points are at height of: -20.0 (sea bed), -19.0, -18.0, -17.0, -16.0, -15.0, -14.0, -13.0, -12.0, -11.0, -10.0, -9.0, -8.0, -7.0, -6.0, -5.0, -4.5, -4.0, -3.5, -3.0, -2.5, -2.0, -1.5, -1.0, -0.5, 0.0 (MWL), +0.5, +1.0, +1.5, +2.0, +2.5,+3.0, +3.5, +4.0, +4.5, +5.0, +6.0, +7.0, +8.0, +9.0, +10.0, +11.0m. Note the increase in resolution of the points between -5.0 and +5.0m.

In each of the two Airy wave cases, Wheeler-stretching was used to calculate water particle kinematics up to the instantaneous water surface.

Values are specified at time intervals of 0.1s. For both regular wave cases, time history records are given for one wave period (10s). For the irregular wave case, a time-history of 630s is given. The additional 30s relative to the 600s specified in [1] is given to allow simulations to be run for 30s *before* data is output, to allow initial transients to die away.

To make the comparison of results from the different codes as straight-forward as possible, it is suggested that we all use common values of hydrodynamic drag coefficient (C_d) of 1.0 and inertia coefficient (C_m) of 2.0.

If there are any queries about the derivation or format of this data, please don't hesitate to contact me by email (camp@garradhassan.com) or telephone (+44 117 972 9929).

[1] CodeComparisonMatrix050921-1.xls